Space Weather Forecast

Issued on Monday 24 February 2025 at 13:12 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate flares likely. Possible glancing CME Day 1 (24 Feb).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was High with one Strong-class flare peaking at 23/1927 UTC, most likely from a region that has recently rotated around the northwest limb. The risk from this region will ease over the next 6-12 hours. There are now nine sunspot regions on the visible disc. The most notable regions are in the southwest quadrant and in the northwest quadrant. The region in the southwest has shown spot development, increasing in penumbral area, with mixed magnetic polarities in the intermediate portion. The region in the northwest developed rapidly at first although this has now stalled, showing some slight decay in its intermediate spots. However, there remains clear magnetic complexity in the trailing portion. The other regions on the disc do not currently appear particularly complex.

A coronal mass ejection (CME) was observed off the northwest limb in association with the Strong flare, but is unlikely to have any Earth-directed impact. A second CME left the Sun around 24/0702 UTC most likely associated with a Moderate flare from a region in the northwest, with the potential to also contain remnants of a filament that appeared to lift of just to the south of this region. Further analysis is needed, but this may glance the Earth on 26 Feb.

Solar Wind / Geomagnetic Activity: Solar winds showed background conditions. Wind speeds varied between 300-360 km/s. Interplanetary Magnetic Field, was initially weak with a possible transient CME arrival around 23/2130 UTC bringing a rise to moderate levels. The north-south component, was initially predominately weakly positive (northward-directed), with a negative (southward-directed) interval between 23/2030 UTC and 23/2345 UTC. It then trended back to moderately positive until 24/0730 UTC when it became variable and weak. Geomagnetic activity was Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: The count rate of energetic particles (high energy protons) was near or just very slightly above normal background levels.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate solar activity is forecast, with occasional M-flares considered likely and a slight chance of isolated X-flares.

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Solar Wind / Geomagnetic Activity: There are two main CMEs in the forecast at present. The first arriving on 24 Feb with a chance of G1/Minor storms and a slight chance of G2/Moderate storm intervals. Solar Orbiter shows this CME may be stronger than the one that may have glanced Earth in the early hours of 24 Feb, which saw Active geomag intervals. However, this is subject to significant uncertainly as Solar Orbiter sits close to Venus, behind Earths Orbit, which may mean the CME passes behind Earth. The second is still waiting further analysis, but potentially glancing Earth on Day 3 (26 Feb). Wind speeds are currently at background levels. Late Day 1 or Day 2 (24-25 Feb) a slight enhancement may occur, associated with a weak coronal hole fast wind, with wind speeds perhaps reaching around 400-450 km/s.

Geomagnetic activity is forecast to be Unsettled to Active (Kp3-4), with a chance of G1/Minor storm (Kp5) and a slight chance of G2/Moderate storm (Kp6) intervals, on Day 1 (24 Feb) however this is generally low confidence due to the uncertainly in the arrival of the CME. Activity then gradually easing back to Quiet to Unsettled from Day 2 (25 Feb). Day 3 (26 Feb) may see a slight increase in probabilities dependant on the arrival of the next CME.

Energetic Particles / Solar Radiation: There is a chance that the count rate of energetic particles may rise to S1/Minor radiation storm levels on Day 1 in response to the recent Moderate flare. In the absence of any increase from this event, background levels are expected to persist, but with a continued slight chance of increasing above the S1/Minor radiation storm threshold in response to any larger flares.

Geomagnetic Storms

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	No	50	10	20	10
Strong	**G3**	No	10	1	1	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

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Radio Blackouts - X-Ray Flares

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	70	70	70	70
Very Active	R3-R5 (X Class)	Yes	10	10	10	10

Solar Radiation Storms (High Energy Protons)

Radiation Storms	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	50	30	15	15
Very Active	≥ S3 *	No	2	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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